SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 999---Vol. XXIV.] LONDON, SATURDAY, OCTOBER 14, 1854. [GRATIS.

NORTHAMPTONSHIRE GREAT CENTRAL COAL MINING COMPANY.

REPORT OF MR. ROBERT BEAUMONT, OF LLANDAFF. 143a

rthampton, Aug. 29, 1854.—In consequence of an application on behalf of the amptonshire Great Central Coal Mining Company, I have examined the property gsthorpe, with a view to ascertain the quality of the minerals, with their approxi- n to the coal fields in the western districts. At Kingsthorpe, two pits or shafts have sunk several years ago, to the depth of about 320 yards or 160 fms.; the journal of the several strata passed through in the course of sinking these pits, and the ap- ce of the metals as seen on the surface, indicate in strong terms that they belong series of red and white marl stone, or lower range of oolite strata. They appear have sunk through the red and variegated marls and new red sandstone, and y have approched the red conglomerate, magnesian limestone, and conglomerate, are embedded next to the coal measures. Finding this to be the case, I have ex- d the strata in Warwickshire, where the easternmost collieries have been opened, ind there nearly the same range of strata; as also at Coventry the same rock is This stone completely resembles the Bath stone, both in texture, colour, and n, under which coals are now being worked, and where a few years ago it was con- d coal did not exist; but by perseverance to a considerable depth, the coal was dis- d, and I believe I may add, the success of this undertaking was accomplished y through my own recommendation to persevere in the execution of their trials. the course of these measures range from Coventry towards Rugby; there the lias one is found in good quality, embedded in the marl, which is made into very fine and pipes, and the limestone ranges along for several miles. Now, as the limestone are also found at Kingsthorpe, it shows a very strong analogy that the coal mea- will be found there also, by proceeding to the proper depth. There is another very ful instigation for going into and persevering in this discovery, which is that one- the work has already been accomplished, by having those two pits, which are al- sunk down 160 fms. In Warwickshire the pits are fully this depth, and new works ng opened to a considerable additional depth, and one colliery has been working coal lower or deep side of the pit, and they find the quality of the coal there to improve. have been dislocations met with in the strata, the effect of which is to raise the nt minerals 100 yards perpendicular nearer to the surface, in an easterly direction; so far favourable; and there is no doubt that others of a similar nature and effect cur. These occurences of nature are found to be of the very greatest utility, by ing the coal and other strata within a reasonable distance from the surface of the for without these the several strata would descend to a depth beyond our reach. equence of having met with a salt spring at Kingsthorpe, in the bottom of the with the limestone on the surface, it may not be out of place to mention that in rthumberland district they have also got the limestone at the surface, and very aline springs below, from which large quantities of salt are made, and some of al pits are 300 fms. in depth. A pumping-engine of about 100-horse power, and g-engine of about 30-horse power, will be required. The late discovery of exten- ore in this district fully warrant a searching attempt for the discovery of coal, will be a great increase in the population; but had iron ore not been discovered, ufficient market to warrants a large expentiture in the production of coal in the e district. In the event of coal being met with, the winding-engine proposed und equal to raise at least 300 tons of coal per day; this may be considered 5,000 tons per annum.

ount of sales and charges, to be taken in a moderate way, I should state as

nount of sales of 75,000 tons at 12s. is	£45,000	0	0
to, charges on obtaining ditto, at 7s. is	26,250	0	0
Profit—Balance	£18,750	0	0

you require any further information or assistance, it will be given with plea- your obedient servant, ROBERT BEAUMONT, Llandaff, Cardiff.

REFORM IN OUR METALLURGICAL PROCESSES, SO AS TO RENDER ALL PRODUCTS AVAILABLE.

In his able lecture, delivered at the Educational Exhibition, St. Martin's Hall, Mr. Herbert Mackworth observed that we had much to learn from the Continent with regard to the safety of mines, boring and coking, and extraction of minerals. The truth of this remark only the most prejudiced of the old school will attempt to controvert. The want has been generally acknowledged, and we trust the establishment of the School of Mines will, in some measure, remedy the evils so justly complained of.

However just and severe this observation may be as applied to our mining enterprise, it more forcibly appears when we consider our metallurgical processes. The general remark of those scientific foreigners who have visited the gigantic establishments at Swansea is, that although the work is carried out in a practical workman-like manner, yet that great waste and carelessness is predominant. The truth of this has been lately shown by the numbers of heaps of slag which, during the last few years, have been re-smelted. There is no want of able analytical chemists in England, who can from a sample extract all the metals and semi-metals it may contain; they are perfect in the uses of the laboratory, but not having a practical education, when their experiments are to be tried *en gros*, in general they are found unequal to the task. In Freyberg, Fahlun, and the Hartz, laboratories are attached to all the reduction establishments; there the chemist has an opportunity of seeing his laboratory experiments practically tested in the furnace: it was thus that Plattner, Von Herder, Weisbach, Reich, Breithaupt, and several other eminent men, obtained their knowledge. In the Hartz, it is well known that the ore contains a quantity of mixed metals; these are, however, separated, and the various products made available. From the same mines are obtained silver, lead, copper, zinc, and sulphur, none of which is wasted, but all rendered merchantable. It has been stated that in foreign states most of the mines belong to the Government, and are supported by grants, and if in the hands of private individuals they would be better developed. It is possible, if there was no supervision exercised, that greater returns would be made, and the system of bureaucracy be checked. Although we are as much opposed as any can be to the system that Governments should be inquisitorial, or enabled authoratively to dictate into what channels capital should be diverted, yet with regard to mines, as well as railways, experience has shown that a wholesome control should be exercised. We have now our inspectors in the coal mines, and we think it would be a step in the right direction if some regulations could be devised for the better government of our other mineral deposits. We will merely ask the simple question, how much capital has been expended through ignorance? How large an amount has been drawn from the pockets of the public through misrepresentation and fraud?

It has been lately urged that, instead of wasting our sulphur as we have done hitherto, it should be saved, and applied to the purposes of commerce. We would not stop here, but an attempt should be made to render available the other metals which are found with the copper ore. Already, although they pay a lower price for the ores, the Swansea smelters extract the silver, yet, singular enough, these astute men have not attempted to avail themselves of any of the gold which was discovered in nearly all the Cornish mines at the commencement of the present year. Gold in England is a pursuit *per se*, and we are content to let it rest to the care of those who have made the astounding discovery. When practical and paying results are arrived at, it will be time enough to canvass the good or evil likely to result from its wide dissemination. At present, although it has attracted no inconsiderable degree of attention, it has not become of that importance which was anticipated by those who were most sanguine when the revelation was first disclosed. Like all gold mining projects, whether in Australia or California, our British auriferous deposits are "under a cloud:" whether they will ever emerge from the obscurity which now envelopes them futurity will disclose.

Our province is not, however, with gold, but with the more useful minerals. We do not address ourselves to the miner, but to those connected with the reduction of metals. At present they obtain large profits at a great waste: how much more would these be increased if due attention were paid, and all products utilised and made merchantable? It may be said, that if a man is contented, he may use his property as he pleases—if satisfied with the profits from the copper, no one has any right to call him to account why he does not extract the silver, lead, &c., which it may contain, or why he allows the sulphur to evaporate, which otherwise he could sell.

This is not a question, however, affecting only individuals, or a few firms: it assumes a national form when we look at the vast interests that are affected by it—when we calculate the wealth that is daily wasted, and the amount of employment and encouragement to home industry that it would give, if economised and rendered useful. It is not our intention here to detail the manner in which our reduction establishments are managed, nor to suggest the improvements that might be made in them. We are perfectly aware that the proprietors of these works have more knowledge on those subjects than we have; yet, unless forced by the competition of one of their own body, they never venture to adopt any technical modification, however slight it may be. The sole reason of this is, that the present system has worked well for them—they dread innovation; as far as regards smelting, however liberal their politics otherwise may be, in that they are ultra-conservative. True, some of them are miners—that is, possessing large interests in mines; they can well afford to lose a portion of their profits there, seeing that, as smelters, they obtain the whole.

It is not, however, from them that the public must expect any amelioration: every change they look upon with extreme jealousy; their own interests naturally make them selfish; and the present system will continue intact as long as they can uphold it.

To avail himself of the benefit of the ores he produces, the miner must render himself independent of the smelter; and he can only do so by reducing his own ores. The system has been pursued on the Continent from the earliest period; the benefits of it are seen in the duration of the mines, which, in many instances, have lasted for centuries. Here we have mines abandoned, then resumed, subsequently "knocked," then revived under a new name, and so *ad infinitum*—no records kept, or any documents, to prevent the public being preyed upon by ignorant agents and designing jobbers.

The School of Mines, we trust, will create a great reform in our mining management—we dare not hope it will extend to our metallurgical establishments; the pressure on them must come from without—they must be taught to avail themselves of the useful products which the ores contain, instead of, as now, wasting them. Let them work to a profit, but let it be a fair one; it is but just that they should have a remunerative return for the large capital they have embarked in their several undertakings. By the utilisation of the various substances, they will be enabled to give the miner a better price for his ores, and to supply the consumer at a cheaper rate, and thus benefit all parties.

The present is an age of progress: they who do not advance must retrograde; and if those most interested do not adopt the improvements which from time to time are shown to be useful, economical, and practical, they may depend that, in this age of utilitarianism, there will be found people who will take the vantage ground they have neglected.

The subject of independent smelting works, or those connected with mines, has often been mooted; it has arrived at no practical result. It must be remembered that no great change has taken place without considerable agitation; whether the question be social, political, or moral, it has always had at starting great difficulties to contend with, heavy obstacles to encounter; it has often been beaten back to its entrenchments, but if founded on a sure basis it has again rallied, and eventually achieved a victory. Let those who are now lulling themselves in fancied security remember that many projects which, twenty years since, were considered chimerical and absurd, are now allowed to be the most useful and practical of the present day.

MINERAL WEALTH OF THE UNITED STATES.

We resume our notice of Professor Wilson's interesting report on the mining and metallurgic position and prospects of the United States. Their peculiar geological features, as seen in the enormous development of the older formations, early indicated the probable possession of mineral wealth, and every state that, from time to time, became sufficiently important to be added to the federal Union, brought with it a dower, not more valuable from the surpassing fertility of its surface acres, than from the hidden riches which lie beneath them. The distribution of the metallic minerals in the different States is, however, somewhat irregular, the rarer metals and gold being found but in few localities; tin only to a limited extent in one place; lead and copper are generally seen associated together, occurring to a greater or less extent in most of the States; while iron is met with everywhere, in some places forming deposits of enormous magnitude, and in others compensating for its diminished quantity by the richness of its ores. The iron ores found in the States comprise every variety known in Europe, save, perhaps, that of our country known as the "blackband." Those principally used for smelting are the magnetic oxides, the hematites, and the clay carbonates of the coal measures; besides these, the "spathic," or "sparry carbonate," and the "oligist," or specular iron ore, are used, but at present only to a limited extent. The magnetic oxides and hematites are dispersed pretty generally throughout the whole extent of the Union, and the clay carbonates are associated with the coal measures lying west of the Appalachian chain—in general they are not so rich as those in our own country; but, when mixed with the hydrated hematites, these lean ores are advantageously worked. In 1830, anthracite coal was successfully used in smelting ores; and when, some years later, it was shown that the hot-blast could be as advantageously applied to anthracite as to other furnaces, Pennsylvania became at once the great centre of the industry, and speedily assumed the control of the home market.

The manufacture of iron has hitherto distributed itself on the line of eight great rivers—the Houseatonic, Hudson, Delaware and Lehigh, Schuylkill, Susquehanna, Potomac, Ohio, and Cumberland and Tennessee. The make of the first division cannot be estimated at more than 10,000 tons per annum, which are consumed, chiefly in the immediate districts, in the manufacture of cast-iron railway-wheels, and malleable iron castings.—2d. The Hudson River traverses the State of New York, and on its line are six large anthracite furnaces; on Lake Champlain, three more; and the rich ores of the deposit deriving its name from that lake are said to work up well by themselves in the anthracite furnaces, without the admixture of any leaner ores, with a less consumption of fuel, from one-third to one-fifth of coal being sufficient to produce 1 of metal. These advantages all tend to reduce the cost of anthracite iron-making in the Hudson district, which Professor Wilson had every reason to believe could be made on tide water at an average of $18 per ton. The quantity made is rapidly increasing, and it is stated that the returns for the current year, 1853-4, will not be less than 80,000 tons.—3d. The Delaware is the next great river, south of the Hudson; in this district are the most extensive and successful iron-works in the United States; and iron can be made on the Lehigh at as cheap a rate as at any other spot in the Atlantic States. In the establishments visited, economy of production was found to be adhered to, the air being heated by the waste gases of the furnace; and in most cases, the steam power, whether for driving the blast or for other purposes, was generated in boilers set in the upper part of the furnace, and arranged so that the heated gases played around them. The aggregate produce of the district may be taken at 110,000 to 120,000 tons per year, which will probably be increased, as new furnaces of the largest class are in progress of erection. Owing to the advantageous position of the furnaces on the Lehigh, and the scale upon which they are worked, it would appear that the actual cost of making iron there would not exceed from $14 to $16 per ton.—4th. The Schuylkill takes its rise in the south-western extremity of the first great coal basin, and, pursuing an eastern course, runs into the Delaware a short distance below the city of Philadelphia. An estimate of the expense of making iron, drawn up in 1850, makes the then average price per ton $17 50c., since which period, prices, both for materials as well as labour, have risen fully 25 per cent. Upon this river there are in operation 18 blast furnaces, using anthracite coal; but these furnaces are of smaller capacity than those on the Lehigh, and their total production may be taken at 100,000 tons per annum.—5th. The Susquehanna is another of the great parallel rivers; in one portion of its course it skirts for many miles the south-western extremities of the first and second coal fields, and the western branch, into which it divides, traverses the centre of the third, the great "Wyoming" basin. Along its bank large deposits of iron ores are met with; iron can be made in the district at a price averaging from $15 to $18 per ton; and in some of the most favourable cases, where the furnaces are in immediate proximity to the ore and fuel, it can probably be made at $2 to $3 per ton less. The iron industry of the Susquehanna is in a prosperous state; the production is already very considerable—not less than 120,000 tons will probably be made in the present year, the greater part of which finds a ready market west of the Alleghanies. Pennsylvania furnishes, in round numbers, one-half of the whole production of iron in the Union—the entire number of furnaces in the State, in 1850-1, was 304, and the actual make 198,813 tons.—6th. The Potomac is the next of the great rivers, taking its course some 60 to 100 miles south of the Susquehanna, and running into Chesapeake Bay about midway from the ocean; and in the district is included the production of Virginia and Maryland. The district is abundantly supplied with ores, chiefly hematites, of good quality. Charcoal is the fuel chiefly used, although the increasing means of communication with the Cumberland coal basin, and with the anthracite region of Pennsylvania, must afford great advantages in the way of fuel to the furnaces placed within reach of the lines of transport. The present cost of coal-iron in this district may be taken at an average of $20 per ton; while charcoal-iron cannot be made at less than $25 to $30 per ton. The gross production of iron of this region may be estimated at 125,000 tons, of which Maryland returns about 100,000, and Virginia about 25,000 tons.

—7th. Professor Wilson has classed together the two divisions, the Ohio, and the Cumberland and Tennessee, not having been able to procure any satisfactory information as to the details and present condition of the iron industry of either. As the demands of the western markets are being supplied by western production, from the best estimates he could obtain the production could not be less than 150,000 tons for the past year. The iron-making facilities of the Western States are yet only partially displayed, but the enormous area occupied by the great Appalachian coal-field secures the possession of an illimitable supply of fuel; while the well-defined existence of beds of clay and iron ore, associated with the coal measures, places the raw material under conditions most advantageous to the manufacturer. These, however, have hardly as yet been rendered fully available to iron-making. Charcoal as fuel, and the hematite ores found on the outskirts of the coal-field, supply the principal portion of iron now produced; and the present cost of making cannot be less than $20 per ton.

If these estimates are correct, the entire production of the States for the year 1853-4 may be taken as 805,000 tons; while the gross amount of iron produced in the several States of the Union for the preceding year, 1852-3, is given at 540,755 tons; the number of hands employed, 20,298; and the market value of the produce, $12,489,077. Taking the present production of pig-iron at 800,000 tons, about one-third of it is consumed for castings, and the rest is convertible into wrought-iron, at a loss in waste, &c., of about one-third, which, for practical purposes, reduces the total or available production about 130,000 tons, and leaves, in round numbers, 600,000 tons, to meet a consumption of not less than 1,200,000 tons; and the deficiency must be supplied by the produce of other countries. The Treasury Returns state the number of establishments for the conversion of pig into wrought-iron at 422, giving employment to upwards of 13,000 workmen; and the entire amount manufactured in the States may be taken at 500,000 tons per annum.

A process, patented by James Renton in 1851, for making wrought-iron direct from the ore, is being carried out on a commercial scale at Cincinnati, in Ohio, and at Newark, in New Jersey. Professor Wilson visited the latter establishment, and the working returns that were furnished to him were certainly very satisfactory, although the operation, which has been several times attempted, has never been successful in this country. The report explains the process in detail, and points out the difficulties to be overcome. A furnace of a peculiar description, resembling an ordinary puddling furnace, 10 feet high, by 6 feet broad, and 7 inches wide, built up in firebricks, forms a kind of large vertical muffle or retort, surrounded on the sides by the flue or chimney of the furnace. This retort is filled with a charge of 12 cwts. of ore and coal, both finely broken, and carefully mixed in the proportion of 20 or 25 per cent. of coal to 75 or 80 per cent. of ore. The combustion of the carbonaceous matter is carried on slowly by the oxygen of the ore, which, when sufficiently deoxydised, is discharged from the bottom of the muffle into the welding furnace, where the heat is considerably increased. The iron is there worked into balls, and then taken to the hammer in the usual way. By this process, the iron cannot be said to be puddled, for it never melts; it is simply welded in what the patentee terms "an ore-welding furnace." He considers that the merit of the process lies in the use of the closed chamber, which prevents the flame and gases of the furnace from oxydising and slagging the ores—the probable reason why all attempts have failed to work the ore in open chambers. A moderately rich hematite was used, yielding about 35 per cent. of metal, and the cost of a ton of blooms was given at $29 63 c. It is evident that a great desire exists in the United States to perfect the manufacture of wrought-iron directly from the ore. Another establishment of some magnitude is now being erected at Motthaven, near New York, for carrying out a process of reduction (Harvey's patent), similar in principle to Renton's. In this, the ore (magnetic oxide) is mixed with a certain proportion of charcoal, both in coarse powder, and then placed on inclined planes or trays (steatite), in a suitable chamber, immediately connected with the welding or balling furnace. A fire at the base of the chamber heats the mixture sufficiently to produce ignition, and the flame, playing over the trays, assists the reduction of the ore, which is then removed into the welding hearth, and balled in the usual manner.

These attempts seemed to constitute the only novelty in the process of making iron in the United States; but in the smelting anthracite furnaces the practice of economising fuel by the application of the waste gases to raise the temperature of the blast, and also to generate the steam-power necessary for the works, is carried out to a far greater extent than with us. Professor Wilson thinks that it merits a passing acknowledgment from him: we would suggest that it deserves general attention, and perhaps adoption, by our manufacturers.

He also mentions another point of interest in connection with this industry—the method of utilising the slags of iron furnaces, illustrated by Dr. W. William Smith, of Philadelphia, in the New York Exhibition, in Class XXVII., where a collection of bottles, slabs, bricks, and other articles, run direct from the reducing furnace, were exhibited. The finish and appearance of the various articles would justify the expectation that the process, if applicable to the slags of coal furnaces generally, would be of great industrial importance, the price being about 4 c. per cubic foot for slabs. We notice this productive use of the refuse of furnaces as well worthy of attention in the vast iron-works of these islands.

GREAT CRINNIS COPPER MINING COMPANY.

It is ever a gratifying duty to have to record successful results arising out of legitimate mining adventure, whether from the development of previously untried ground, or where a company, with praiseworthy enterprise, take up the exploration of a mine which under former workings was productive, but from untoward circumstances has been abandoned, and to which in general a considerable amount of interest attaches. The Great Crinnis Copper Mine may be considered as a striking instance of the abandonment of a valuable mine, and its re-working after a lapse of many years, during which time it lay idle. In last week's Journal we inserted a full report of the second general meeting of shareholders, at which the details of the reports submitted, and the declaration of a dividend of 5 per cent., gave much satisfaction. The resolutions passed will be found in our advertising columns. This undertaking was worked from 1808 to 1828 with most astonishing success, as during that period the returns are said to have amounted to 1,500,000*l.* Previous to the first-named date several unsuccessful attempts were made to make the mine pay its way, when Mr. Joshua Rowe, of Torpoint, set it afloat again, but the shareholders fell off one by one, leaving him to bear the whole cost, when he hit upon a rich mass of ore, and in five years made a clear profit of 168,000*l.* The seceding adventurers then demanded a restitution of their shares, which Mr. Rowe very naturally refused to grant: a law suit was the consequence, which lasted many years, and although he eventually got a verdict the mine was neglected, the returns fell off, and it was at length entirely given up in 1829. During the period of its great success the dues were as high as one-eighth; and Col. Carlyon and his father, during 20 years, received from this source nearly 170,000*l.* In August, 1852, the property was again taken up by a company, who subscribed a capital of 30,000*l.* in 1*l.* shares, with the object of erecting the necessary machinery to fork the water, explore the old workings, open new ground, and develope some of the old lodes which have already been discovered in the sett, which is of considerable size, extending over 100 acres. The dues may now be considered fair and reasonable—1-24th until the produce shall exceed the cost, when 1-16th is to be charged. There is no surface water, except for condensing purposes, which serves for dressing also.

The reports at the meeting alluded to fully set forth the present state and prospects of the adventure; the position of the mine is in every respect satisfactory, the water is drained to the 80 fm. level, and the shaft is fast getting down to the 110, when a large field for further development will be opened; and there appears every reason to hope that the returns will be very soon of a most important character, and the mine prove of greater value than the most sanguine ever anticipated. Already some rich ores are raising from the 56, 40, and 24 fm. levels, and very shortly sufficient ground will be laid open to set many additional pitches. The balance in hand from the sale of ores was 1767*l.*, from which a dividend was declared of 5 per cent.; and as there is now every prospect of the mine continuing to work at a profit, it is to be hoped the committee will be enabled to continue at least an equal amount at stated intervals. All experienced miners are sanguine as to the results of the Old Crinnis Mine, and when its former wealth is considered—when it is remembered the mine is yet but shallow, that there are other lodes parallel to the large one which yielded so largely, and that they are situated in a district remarkable for its mineral fertility—it will not be surprising if in a short period, by judicious economy and spirited enterprise, this mine takes a station in A 1 among Cornish adventures.

Original Correspondence.

ENNOR'S VIEWS ON THE IGNEOUS THEORY, AND THE EARTH'S NATURAL LAWS.—No. II.

I would next call attention to the different layers of crystalline rocks, noticing lime, quartz, sandstone, and slate, with many others. These rocks, when crystallising and forming beds or layers, accumulate chiefly on the upper side, imbedding fossils. The granite tribe is accumulating principally on the under side—that is, in new forming layers, and they are rising upwards, carrying the gold, tin, trees, and fossils up with it. I have seen good streams of tin on granite so soft as not to bear persons to walk on it. This is often called decomposing granite; I believe it to be a layer of new forming granite that has carried the tin in many instances 100 feet above its original level. No fossils will be found in these layers. When they were boring off Padstow Point, to ascertain the nature of the rock below the sand, it was found that a layer of blue tenacious clay lay between the sand and slate rock, which I have no doubt is a new slate layer, forming from a substance coming up from below, and not unlikely to contain fossils. All the lime tribes are fast growers and preservers of fossils, accumulating chiefly on the upper side, which accounts for their productiveness of fossils.

Coal is said to have been once trees, or some vegetable substance, but it is as much a rock as any in the earth: it has its cross-heads, cleavage, and faults, and is only to be found in its own native soil. The quantity and quality is dependent on the contents of the adjoining strata; these beds only live their season, as all other rocks do. Having before hinted as to my views of the analogy between the working system of the earth and man, I will here endeavour to give a further explanation on this point. We know man is a complete piece of mechanism; he must have arteries, veins, and ligaments, to perform their rounds of duty. May not the earth require the same! We have undeniable evidence of the earth containing three distinct classes of veins or lodes, probably more.

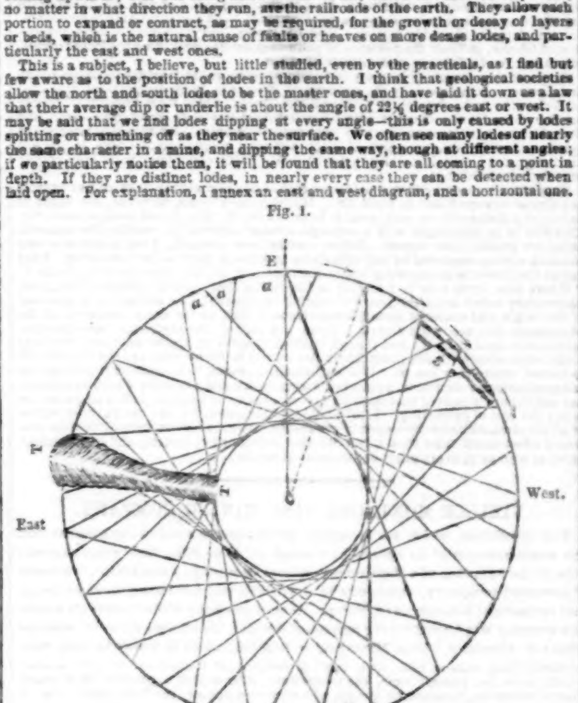
We find one class, which may be termed the mineral-bearing, and which is composed of quartz, iron, mica, lime, arsenic, sulphur, and other mineral substances. A second class is composed of tenacious clay, in which ore is seldom found to a great extent: these are termed flookans, or slide lodes. A third class is the elvan, which is a hard, dense lode, containing quartz in small crystals, often mixed with hornblende, lime, or felspar; they are seldom porous, but little water passing through them, and contain little or no mineral substances to value, although they are generally thought to have a tendency to cause mineral-bearing lodes to be more productive when in contact. Then we have, also, the stratifications dipping into the earth, and in nearly every case crossing the lodes.

We see the earth hourly pouring forth her bounteous supplies, to keep up animation, which must all return to her again in rotation. Then, how is she fed? Through what source? Is it through the stratifications or lodes, or may it be at the pole or poles?

I am not skilled enough in anatomy to know what lodes may act to the earth as arteries, veins, or ligaments. I am certain that, so far as man ever penetrated the earth, in mineral veins he will still find the waters, minerals, and gaseous current, coming upwards; and one thing more is clear to me, which is—that the clay veins, no matter in what direction they run, are the railroads of the earth. They allow each portion to expand or contract, as may be required, for the growth or decay of layers or beds, which is the natural cause of faults or heaves on more dense lodes, and particularly the east and west ones.

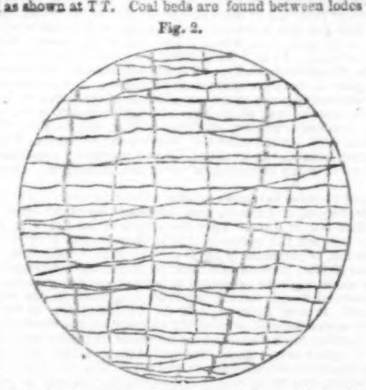
This is a subject, I believe, but little studied, even by the practicals, as I find but few aware as to the position of lodes in the earth. I think that geological societies allow the north and south lodes to be the master ones, and have laid it down as a law that their average dip or underlie is about the angle of 22½ degrees east or west. It may be said that we find lodes dipping at every angle—this is only caused by lodes splitting or branching off as they near the surface. We often see many lodes of nearly the same character in a mine, and dipping the same way, though at different angles; if we particularly notice them, it will be found that they are all coming to a point in depth. If they are distinct lodes, in nearly every case they can be detected when laid open. For explanation, I annex an east and west diagram, and a horizontal one.

Fig. 1.



A man starting at E, and walking west round the globe, laying down these lines for lodes dipping west at about the angle of 22½°, they will be found to intersect, as shown in this section. East and west lodes are only angular pieces, as shown at *a a a*, between north and south lodes. If mountains were produced from interior heat, it would be found as shown at T T. Coal beds are found between lodes with faults, as shown at S.

Fig. 2.

North  South

This plan is shown horizontal: supposing it to be one-eighth of the earth's diameter below the surface. To show north and south lodes nearly as lineal lines. It also shows the faults on the east and west lodes.

You will notice all the lines in Fig. 1 are marked for lodes, and dip at the angle of of 22½ degrees west, which all cross each other, and avoid the centre, leaving about one-third untouched, which accounts for a portion of our lodes dipping east and others west. If we suppose only one lode in a quarter of a mile, at the earth's surface, there would be, at these intersections, miles of metallic matter, forming a crust, as a protection around this centre, axis, or fulcrum. It will be seen from this that the east and west lodes cannot be any thing more than the pieces marked *a, a, a* in the crust or outer surface; and these are moved out of a lineal direction by nearly every north and south lode, as seen in the horizontal diagram. Whatever the interior strata of this globe may be, it is clear, from the known law of lodes going into the earth, that there is something far more systematic in its working than is generally supposed; and when we contemplate the working system of man, and the beauty of creation, we have every reason to come to the conclusion that God, in his wonderful works, left this globe a living type of mechanism, composed of different portions of matter, to which we can neither add nor diminish; and whether the average dip of north and south lodes is 22½ degrees, or even ranging up to 45, it would not alter the law—it only leaves a larger space or centre for the laboratory of Nature; either would show that these lodes or veins are the working sources of the earth, renewing and reproducing everything over and over for ever, for the support of man and all creation—through them, everything requisite is brought to or near the surface, within the reach of man.

It would be absurd to suppose that God created a world composed of every thing necessary to make it a complete piece of mechanism; and after some 8000 or 10,000 years it is found that man had dug up all the gold and other metals, with all the coals and mineral substances; when the then existing creation would suddenly find themselves deprived of all these most essential parts of the earth's formations. This is not likely to happen, as it all returns to the earth to be reproduced, certainly not in the same situation, but it may again form in others far more convenient. If we suppose that the miners of Cornwall had dug out all the copper on the backs of Cornish lodes, that will not deprive the world of copper; new formations will be found, or these lodes may be compared to a tree maimed in the upper shoots, when fresh branches will spring from below and again bear its fruit. It must be borne in mind, that if damaged lodes do not shoot out side or parallel branches, they may cause ores to accumulate some 50, 100, or even 500 miles distant.

Man has dug up iron from the earth as long as we have a record of his existence, still we have no deficiency of supply, neither are we overstocked, and who will deny that the iron used by the ancients is not again in the earth, and even in our present lodes. It was thought that the ancients had deprived us of the great deposits of gold, but see the discoveries in the present age: yet we cannot keep it; the bulk of it will return from whence it came. In no age will the earth refuse to yield up her supplies. Man at times may be negligent and deficient through want of perseverance, which is the moving power. The caverns found in lime rock are nothing more than ventilating passages for water and gases produced in the earth. It is to be compared to air placed under water: in its passing up it would form cavities, but when the air ceases, the water, from its fluid nature, closes; but the earth's gases and waters are a continual source that flow, and must and will have vent, though I believe it to be like the fishes in the sea, or animal and vegetable creation; the former, though immersed in a fluid of immense weight, neither see it or feel its effect. The animals and vegetables, immersed in an atmosphere, are precisely the same; the only effect is, when a strong wind blows they meet resistance. It is the same with fish in strong currents of rivers or tides. Gases and water meet the same resistance in the earth; when passing through rapid crystallising layers they have to struggle hard. These checks are often visible to man. Hence, we see everything working under the same law, whether it be animals, vegetables, crystalline rocks, lodes, or deposits of ore. They come to perfection agreeably to the congeniality of the elements they are in.

I would further notice that every ponderous substance is carried uppermost; see gold, tin, lead, antimony, iron, &c., and even the fruits of vegetation. The acorn and the grain of wheat will send a thousand per cent. upwards. Copper, being one of the lightest ores, is often found deepest: it is on these grounds that I oppose deep sinking in search of productive mines, and ask for precedents. Even the extraordinary paying copper mines show extra gossan at shallow levels, or produce the ore within 40 fms. of the surface, and all other productive mines do it long before they attain that depth. The larger the deposit of ore, the deeper the ore is likely to continue. A casual bunch of ore might be first found at an intersection 100 fms. deep, but show me precedents as to their being over remunerative. I believe the heart of large bunches of ore is obtained in nearly every case before reaching the 150 fm. level, and are all but extinct when they reach 800 fms.; this depends much on its bulk and age. The law of lodes requires watchfulness and study, far more than the working system of man. Lodes may be found in every grade of life, the young, the middle aged, and the time worn. As they near the surface they are to be compared to the veins in the arm of a man, branching into the fingers, and for deposits of ore dependent on the stratifications, directions, and intersections, which bring the interior magnetic current to act on one point, producing powerful chemical action.

I believe all our lodes contain ore of some kind in their season, which is mainly dependent on their age and adjoining stratifications. They are tender and gossany in early days, bear their fruit in middle age (the ore), decompose when old, and the gossan becomes hard capel; these changes are dependent on the acting current which causes the growth or decay of the adjoining stratum.

I beg, in continuance, to notice that mineral crystals are as flowers on trees, and chiefly found in young lodes near the surface. In most every case the ore is then of a good quality; at middle age, it is in greater quantities, but not equal in quality, with the exception of about the heart of the bunch. In old lodes, the ore is passing off in solution, reducing in quality and quantity, often depositing native copper when in contact with any layer containing magnetic iron. Ores, when depositing in lodes, from their own chemical action, decompose the sides in the most congenial places, making room for their deposits; hence we see swells in lodes where there are large bunches of ore.

In decaying lodes, we often see in vughs, or caverns, the prints of cubes and other crystals that were once there, but now decomposed and gone; this shows the matrix to be more durable than these crystals of ore.

As a proof of the crystallisation of rocks, I may remark that I have seen thousands of six-sided quartz, formed on the sides of levels, after they had been excavated; and once in a level that I assisted to drive through, a large quartz lode; and on re-opening it after the expiration of six years thousands of quartz crystals had grown, 2 in. long, and as large as straws. On rubbing them between the hands, they again became a liquid. I have no doubt but hundreds of old practicals have noticed quartz growing, as I have often pointed them out to mine agents in my rounds.

Carbonates of lead will grow in strong lead lodes 1 in. long in 12 months. I have seen a stone taken from a strong lode, productive of carbonates of lead, when brought to the surface, and kept in a damp place, shoot out white carbonates, as branches will for a season from a detached piece of green wood. Many specimens of young crystallising rocks could be detected in the short space of seven years, if carefully looked for.

I saw in Treburget United, not two years since, hundreds of shales of carbonate of iron adhering to the sides, and even to a piece of wood floating on the water; this mine has not been opened above seven years. We are told that native silver has been found in mines adhering to timber, and crystals of tin to leather. We have also the members of the Cornish Geological Society's authority to say the elk's horn has become the oxide of tin; and the horn is in their possession, and is open to inspection. The horn lay imbedded in the alluvial tin layer, previously washed down from the mountains, where the tin lay slowly dissolving, as all substances do, when in solution and passing on, it came in contact with the horn, when the lime caused a chemical action, and it dissolved, and gave place to the oxide of tin, where I am told it has taken the form of crystals of lime. Here is a double action, as there can be no doubt of its first passing in solution through the lode, where it crystallised, and became an oxide of tin before the Deluge, when it was washed into the valley; it there again slowly dissolved, and passed off in solution, and, re-formed in the elk's horn, again producing the oxide of tin.

Any person by calling on Mr. J. T. Tregellas, of Truro, may see with him a lot of crystals said to be felspar, but they are not unlikely to contain a large portion of lime: many will be found of their original substance, and others all oxide of tin—some a quarter, others half; in fact, they are in every grade, proving their first passing into a solution and re-crystallising, a transition of substances.

At Rinsey Mine a transition of iron is taking place, and the granite alongside the lode is becoming iron. Hundreds of other proofs could be produced, if required, of the solution, transition, and re-crystallisation, of mineral substances: had we only these proofs, it would have been sufficient to show that rocks live and die, and are reproduced by crystallisation; and at a low temperature native copper is produced in twelve hours, when no man can detect a warmth in the water: heat may have a tendency to produce it quicker, but it is only like a hot-bed—it is forced, and is not produced in its native element. In fact, the whole of the mineral crystals are living proofs of the capability of rocks to form by crystallisation; and the earth is still performing and showing its beautiful working law every day, and producing the crystals within 10 fms. of the surface, without a heat perceptible to man, even when he is alongside of them. Next, look at the stratifications; if ever so dense, and there happen to be a vacancy, commonly called a vugh, or cavern, in it will be found the natural crystals of that layer or bed of rock, brought up to perfection. Look at the Cornish quartz, more commonly called the Cornish diamond, found in Tintagel Cliffs, in vughs imbedded in a black, sooty substance. We also see able chemists, if they will allow me the term, using their hot-beds to produce crystals from mineral rocks. I think these are ample proofs that all our rocks are, and ever were, produced from crystallisation, requiring no further heat than the rocks of Cornwall now contain to produce every substance therein found.

Can any one for a moment suppose that the large cubes of sulphuret of iron, or mundic, so often found, were formed as now found, when God said, "Let there be a world!" or that, at any later period, they sprung into existence in the twinkling of an eye? It is a work of time—it lives and dies.

It would be highly absurd to say that all the gold found in Australia was formed in nuggets, as now found, when the world was created. It is said by some that it exists only in its metallic state. I contend that gold is like all other ores—continually passing through the earth in solution; and when the seed is sown in congenial ground, there it will collect and form a body; and every other ore collects in the same way. It may be compared to the oak of the forest—one of the longest livers when formed. I am not aware that any man can detect these ores by the eye in their primitive state, when passing on in solution through rocks, or through waters, or in passing off to the atmosphere in gas. Still, it unites and forms a body when in its own element, and met by a relieving flux, just as copper when met by metallic iron, or the tin when met by the lime in the elk's horn, and without any perceptible heat; though it is rather difficult to come to a conclusion as to how ores accumulate—whether condensed from gases, and formed on the outside of crystals; or whether, like the tree, it exhales its supplies from the rocks through which lodes pass.

Judging from what I have seen of the carbonates of lead shooting from a stone, detached, and deposited in a damp place on the surface, and the needles of antimony, also thousands of quartz crystals seen shooting out from the sides of levels driven in apparently clay or slate rock, I am inclined to think it much like a tree, first springing from the seed, when it draws its supplies from the lode and adjoining rocks, until it reaches its climax.

Nature clothed everything with its own working law, which carries it to perfection; but these are things which require watchfulness and study, and will not be detected until the most able of the young practicals become chemists, and employ their leisure hours in their own laboratory.

Ores in their primitive state are the acids or salts of the earth. They are passing through all lodes and stratifications in which they are found deposited, and, no doubt, could be detected by the able chemist. This is the field for cultivation, to develope the natural and true laws of minerals. After these remarks, it would be a waste of time to follow further the interesting work of crystallisation.

I will next endeavour to show that the different ores of Cornwall are the productions of different eras. The oxide of tin, wolfram, and a few other substances, with a small portion of gold, was to perfection long before the Deluge took place, and by it was brought down into the valleys; but we see little or no copper, though we are often told that the ancients did not know copper, and where they came to it they abandoned the mine, or threw it away to build hedges and make roads. I have myself seen hundreds of places opened that were never worked since the days of the Druids or Romans, but I never saw one left by them worth working for copper. As to its being used to make roads or hedges, I never saw a single instance of it left from the ancients, but I see too much put for that purpose in the present day. If I was to offer 10*l.* for the man that could prove he ever profited 100*l.* for copper found in hedges or roads of 500 years standing, I think there would be no claimant. I firmly believe our lodes contained little or no copper when first worked for tin; it is of far more recent growth. We can now find copper in a thousand lodes in Cornwall and Devon, ranging within from 2 to 20 fathoms of the surface. It is a singular thing, if copper then existed that the ancients, after opening extensively on nearly every lode, should never have laid open a good copper mine.

Lead is also a recent production in Cornwall, and even more so than copper. It may be called a surface ore: thousands of tons have been raised within 5 fms. of the surface, and even in the alluvial soil, but we can find none carried into the valleys, as the stream tin. Let us suppose it was in the lodes at the time of the deluge, what was to prevent it from being washed into the valleys, as the tin was? But we cannot find any; it was never washed there. It may be said that lead quickly becomes an oxide, and is gone off in solution, but this requires more time than many suppose. If the lead was then in the lodes, it would now be found in our valleys more plentiful than tin. To prove this, I will refer your readers to North Wales, where a large portion of the lodes are old and decaying; their gossan in nearly every case has become capels, and the lodes in depth only termed by Welshmen joints or strings; though I believe them to be the remains of once large and productive lead lodes, lodes that were rich in early day, and even before the Deluge. Fine stones of ore are now to be found in the valleys, and known by the name of "tumblers" to Welshmen. The stones are from 1 lb. to 1 cwt., which shows that lead has stood from the Deluge up to this day. Look at Nant-y-Mwyn, where the lode may be seen for a considerable height in the cliff of the mountains, in some places all washed off, and in others patches may be seen standing, but with little or no lead to be seen in it; but tumblers of lead are to be seen for miles below it in the alluvial soil; in fact, the ground below is streamed equal to any valley in Cornwall. This is said to be done by the Romans for lead. I have seen, myself, stones of 30 lbs. each in the alluvial soil, in ground that was thought too poor to pay for streaming, which is a clear proof that lead would have endured long enough to be found in our streams, if carried there at the time of the Deluge. Your readers will not suppose that I mean to insinuate all the Welsh lead mines are worked out; far from it. I have no doubt but many of them still contain quantities of good ore, but not to the extent they did at a more early period.

Returning again to Cornwall, I would notice antimony, manganese, and iron; they are all ores of recent growth, and rarely to be found carried into the valleys with the tin. All practicals must be aware that thousands of tons of these ores have of late been found within 30 ft. of the surface; see the Goss moor. It has all been streamed for tin; and near the Indian Queen the manganese has been worked extensively to within 2 ft. of the surface, but it is not distributed over the moor, as the tin is. Iron lodes are now worked in the midst of the moor, all of which are formations far more recent than the tin. The late discovery of antimony at St. Endellion was 7 ft. wide, on a hill, and within 2 feet of the surface, but none is carried into the valley; had it been there at the time of the deluge, it would have been swept away like the tin.

In further remarking on lodes and strata, I will endeavour to show they are moved by what are termed faults, or heaves, which are produced from new crystallisations or the decaying of old ones; it is the decaying of one stratum and the growth of an-

[illegible] This, by a careful observer, may be seen in every stage; on one side of a lode [illegible] often come to perfection in half the time they do on the other, which must make [illegible]; but it is all a work of time, quietly going on, and nothing like volcanic or sudden eruptions; nothing apparently disturbed. To explain this, I send you a diagram of a lode and two cross lodes, accompanied with a natural one in a stone, and on the same scale as the diagram,—a clear proof of its working law:—

[This section is a copy of a natural fault in a stone sent on to the office, and on the same scale. Here is the right and left hand fault, or heave, beautifully shown. It is a prevailing law. Beds, or lodes, fall towards the point of the V piece. To discover the direction of the fault, it is necessary to know the bearing of the next lode.]

I could produce many more such pieces if required; it is the law of Nature, and who can dispute it? Here is the right and left-hand fault distinctly shown on the same [illegible] caused by two cross lodes, taking it at different angles; it is a V piece, which in nearly every case is cut off from its supply of crystallisation and magnetic currents, [illegible] goes right or left, and the V piece withers and dies, in which the lodes, beds, strata, continually sink, until it becomes extinct, and a and b close. You will next [illegible] of the lode c; if you were to put it back it is not of sufficient length to fill the [illegible]. On a large heave this deficiency would be considerable—in fact, c will sink [illegible] it is all gone. It is a natural prevailing law, and beautifully shown in coal beds; it is the only true guide for heaves, showing nothing could produce them but the growth or decay of strata. All well-informed practicals know that clay lodes cause the greatest faults, and very natural to be accounted for. They are, as I said before, the railroads of the earth, and allow portions of the earth to expand or contract; the crystalline rocks require it. No interior heat at any time could possibly force up mountains, or remove lodes, as this is. The deficient portions of lodes would have been still visible witnesses, mixed up with every layer, showing the wreck of Nature. As a stronger proof, we have often a second lode in the V, and moved at a different distance, which could not arise from any other means than the growth or decay of [illegible]. If these moves were caused by volcanic eruption or inward tendency, each lode would have been moved the same distance, it must have severed and destroyed all the [illegible] of the earth, as shown at T T in the diagram, and left her powerless, without a [illegible] to stimulate her to produce an atmosphere to support a living being on her surface. I am aware that it will be said that we have volcanic mountains still at work; no one will attempt to deny it; but what are they?—nothing more than beds or lodes containing bitumen, or other mineral substances near the earth's surface, which take fire spontaneously, and burn until exhausted: they are rare occurrences, and not [illegible] on the earth's surface to a pimple on a man's face. I admit they form mountains of a known character, but from what? Nothing more than the melting matter that adheres when cooling near the top. It never becomes a stratification, nor do lodes form in it; minerals ejected from it may form casual crystals. This corrupt ejected matter, when spread over the original layers, are as distinctly to be seen by men accustomed to stratifications, as the sun is by the community at large at noon day. The [illegible] form of these mountains would not allow them to be shown as evidences against our mountains as not being formed by crystallization; they have no similarity to each other.

Every man who has a taste for the wonders of Nature must have noticed the beautiful tree-like crystals found on a frosty morning against the glass of his window, all with their tops upwards. There are but very few, however, who are aware that stones with a smooth surface are to be known on a frosty morning by the same thing; every tree-like form crystallised on them will be found to show its branches tending upwards, as the stone stood when it grew in the earth. The original position may be found from this simple fact 50 years hence. It is a beautiful freak of Nature for our guidance, and a thousand others might be found, if sought for.

[*To be concluded in next week's Mining Journal.*]

ON MINING IN CORNWALL AND DEVON.

BY CAPT. CHAS. THOMAS, OF DOLCOATH MINE.*

I beg to send you the following remarks on mining in Cornwall and Devon. If you think they are calculated to awaken attention to that department of mining which has until recently, has been much neglected, and is still, as to general principles, imperfectly understood, they are at your service. I refer to the geological and mineralogical character of the rocks which have been found most productive of metallic ores. After having made rather extensive observations, I am led to conclude that a careful and experienced miner may anticipate the results of mining operations in any specific locality, with a great degree of probability; but more especially as to the non-existence of metallic ores, or not in sufficient quantities to pay the cost of working.

I. Granite.—The lodes in some of the varieties of this rock have been found to be productive of copper and tin; whilst in others they have, without exception, been unproductive, or nearly so. That kind of granite which has been found to be productive, although varied in its structure and composition in different localities, may be described as follows:—Fracture rough and irregular; very jointy; frequently containing hornblende; is frequently traversed by regularly-formed elvan courses; vast portions of it, like ribs, project from the main body into the surrounding slate. Its localities are, some of the outskirts of granite districts; the hollows between high hills; the base of lofty peaks rising from the interior of such districts, and sometimes rising in such situations into small hills itself. The configuration of the surface alone, to an experienced eye, would, for the most part, indicate the position of this kind of granite. The granite at Tresavean Mine, where it forms a junction with the clay-slate, is of a great depth. In tracing it westward it is found to get gradually thinner. At East Frances, a mile and a half into the granite district, it ceases to yield copper. At the Nine-maiden Downs, the primitive granite rock is found with only a thin covering of tin-producing granite. This primitive rock extents over a large part of Sithney, Wendron, and the south of Camborne; and in it no mine of value has been discovered. Passing on to the south-west, we again meet with a margin of the productive kind; and there we find Wheal Trannack, Wheal Trumpet, and Trevennen Mines. Trumpet Consols and Wheal Lovell are found in the flats in the same neighbourhood, and Porkellis United, three miles from Killas, in a hollow between bold hills. In this district, as well as in other tin-producing districts, in the interior of granite ranges, shoots or ribs from the prominent hills, intersect the adjacent country, and, coming in contact with the lodes, render them unproductive. Mr. Henwood, in his remarks on the granite in which Wheal Trannack and Wheal Trumpet are situated, says, truly, that where these mines were rich the granite was coarse-grained, but becoming at deeper levels close-grained, the lodes failed to poverty. Between the primitive granite hills of Godolphin and Tregoning, a portion of productive granite occurs—the site of the Great Work Mine. This kind—thin at the top—deepens eastward, and where it extends the lode has been found productive; but on reaching the primitive bed, the continuation of the adjacent hills, the lodes became poor. From Carn Brea Castle can be seen the top of the productive kind at the base of the hill, and covering a part of its side, thin at first, and gradually thickening till it forms a tolerably deep bed at the Carn Brea Mines. The Caradon Hill at its south base, as well as the west, stretching away some distance into the Craddock Moor, filling the intervening hollow, has also a border of productive granite; but getting thinner and thinner as it recedes westward, until the rock, without any signs of metallic lodes of value, fills up the rest of the district. This diminishing thickness of the productive granite was clearly shown in the St. Cleer Mine, situated on the low ground east of Craddock Moor. Near the surface the lode was very large, containing a great quantity of gossany matter, and a little copper ore. The primitive rock, however, was soon reached, and the lode found split into innumerable strings, leading to the abandonment of the mine. Another example, under similar circumstances, occurs on the east side of Rosewall Hill, sloping down towards St. Ives. Rosewall Mine, situated half way up the hill, was rich in tin, while the lode continued in the upper covering; but on reaching the primitive rock it failed and became worthless. St. Ives Consols is in a deep bed at its base.

As the productive granite commonly occupies the base of lofty hills, and the margins of some extensive granite districts, so the bold prominences and unbroken central portions, may be safely assumed to be essentially of a primitive character. The principal hills and districts of this kind have been already named in pointing out the localities of productive granite. Among other hills of the same kind in the west of Cornwall may be named, Castle-an-Dinas (north of Penzance), Carnmenellis and Carnmarth (between Redruth and Wendron), and in the eastern part, Rough Tor, Brown Willy, and Kit Hill. Primitive granite, when not bordered by the productive kind, usually passes gradually into other substances. Sometimes crystalline [illegible] rock intervenes between it and the clay-slate. Such is the case between Tregoning Hill and the clay-slate at Wheal Vor. At other times schorlaceous rock (schorl and quartz) occupies that position. Instances of this kind occur on the outskirts of Dartmoor, Brown Willy, Carnmenellis, east part of Carn Brea, and Land's End. Roche Rock is composed of this substance.

Primitive granite may be further distinguished by the perfection of its character, if I may be allowed so to express myself. Composed simply of quartz, felspar, and mica, or talc, it contains no heterogeneous matter like the productive kind, having no hornblende and other ingredients intermixed. The crystals of felspar are also more perfect than in the productive kind; and being less jointy it may generally be split with smoother surfaces. The ideas suggested by its structure, as well as by the lofty hills and unbroken plains formed out of it, are those of substantiality, firmness, immutability; just such as we might expect it to be coming fresh from the hands of the Creator, exhibiting, in the mass, no signs of disturbance by the elements, no rending or upheavals by earthquakes, &c.

After forty years' experience and careful observations, made in all the mining districts of Cornwall and Devon, I have come to the conclusion that the two kinds of granite, which I have described above, differ as essentially, in many respects, as granite and slate; that which I have called "primitive granite" contains no metallic lodes; that tin ores are found nearest to it, and copper ores of value never in or very near to it. In the other kind of granite which I have described, and which I have termed "productive," where lodes of suitable size, character, and direction [illegible], some of our most valuable mines have been found, and others may be looked for. The tin and grey copper ore are commonly found when quartz and schorl are abundant, and yellow copper ores in connection with a similar proportion of felspar.

Mr. Henwood says that courses of ore found in granite, or in clay-slate or greenstone, near to granite, almost always dip from the granite. This is usually the case, but instances to the contrary have occasionally come under my observation. But when the dip has been towards the body of primitive granite, as soon as it is reached, a failure invariably and immediately takes place—in both cases clearly showing that [illegible] ores have no place in this rock. If with such facts before them, capitalists, relying on the speculations of theoretic geologists, regardless of the experience of practical men, will expend their money in vain efforts to explore the almost impenetrable and barren rock, they will find, indeed, ready means of absorbing their surplus [illegible], but their coffers will never be replenished from mines in that kind of granite.

II. Grauwacke Series.—Surrounding the several granite ranges, we find the grauwacke series, including several varieties of clay-slate (sometimes termed argillaceous [illegible]), and the varieties of greenstone. These compose the surface of a large portion of Cornwall and Devon as far east as Exeter, which forms the boundary line of the mining field of the two counties. Profitable mining, however, has hitherto been limited almost entirely to a zone about 12 miles wide, extending due magnetic east and west, from the Land's End to Exeter. The whole of these series, there can be little doubt, lies on a bed of granite, filling up the depressions; but what its greatest depth may be has not been ascertained, nor can an estimate of it be always formed from its distance from the prominent granite ranges. The cross section of Dolcoath Mine shows that the granite lying to the south of the mine dips at an angle of about 45°, till it reaches the depth of 100 fms. from surface. It then becomes for a time more horizontal, and after forming a valley 120 fms. deep, it rises on the north to within 80 fms. of the surface. After passing this underground hill, the granite assumes its former dip of 45°. The base of this hill, at the depth of 120 fathoms, measures from north to south about 110 fms. Taking these ascertained facts for our data, we may, I think, reasonably infer that the granite beneath its stratified coverings has a conformation of hills, valleys, and level plains, similar to what is presented to us in granite districts, where it alone forms the surface.

There are found in our mining districts extensive tracts of rock and strata, ascertained by experience to be of that kind where deposits of ores are usually met with, which I proceed to describe.—Greenstone: This rock often abounds in the vicinity of granite, either lying on it, or imbedded in irregular masses in the slates—never found like elvan, in even courses. When very felspathic, it seems to pass by irregular and a gradual transition into compact or thickly lamellar clay-slate. It varies in texture and composition like the other rocks. When composed of felspar and hornblende, having a rough fracture, with lodes in it of fair size and favourable direction, it yields copper in abundance; when the same ingredients are fine-grained, and the fracture smooth, or when the composition is quartzose, it is only slightly productive. No variety of it contains either tin or lead in any great quantity.

Of clay, or argillaceous slate, there is almost an endless variety, both as it respects the ingredients composing it, the structural arrangement of its particles, and its various colours. One variety is nearly as compact as greenstone, and, like it, composed of felspar and hornblende, with an addition sometimes of chlorite. In Camborne and Illogan, the colour is either dark or of a deep blue, and so much mixed up with greenstone, and bearing such a resemblance to it, as to seem of the same geological age. In some localities—in St. Agnes, Perran, Devon Great Consols, Great and East Crinnis, and Treskerby, a variety of clay-slate is found, some of whose characteristics are very felspathic, compact, or thickly lamellar; in the cross fracture, almost granular, containing very little hornblende, colour light, decomposing more or less on long exposure to the atmosphere. Another rather prominent variety is found containing less felspar, and more quartz, with a portion of alumina (mud); colour, as found in Wheal Friendship in Devon, and South Tolgus in Redruth, blue; at Bosprowal in Gwinear, and some mines near Marazion, the colour is nearly black. Colour alone is of little importance; the composition and structure are the most important considerations generally. The first two varieties are favourable for copper generally; the last variety only when the lodes found in it approach in depth towards elvan courses, containing large portions of felspar. Quartzose elvan is not so favourable for copper.

The clay-slate peculiarly productive of tin is either very quartzose, as at Wheal Vor in Breage, and Polgooth near St. Austell, or micaceous, as at Charlestown United, near St. Austell. When about equal portions of quartz and felspar are contained in it, both copper and tin are found, but neither of them in large quantities. The characteristics of clay-slate peculiarly suited to the production of lead ores are—alumina in large proportion; colour light blue, and then decomposing, or else not so blue, and then less decomposing. Clay-slate producing lead contains a large portion of alumina, and is not crystalline.

Zinc ores (black jack) occupy a position between copper and lead, not unfrequently mixed with both. Other varieties of clay-slate, nearly if not wholly barren of metallic ores, occupy large tracts of the surface of the two counties. They are found passing by almost insensible transitions from the flooring and roofing slate, through the dry shelving slate, forming many parts of our cliffs, and comparatively barren lands, down to deposits of muddy matter. Rocks of every kind containing a large proportion of felspar, indicate the presence of yellow copper ore, providing the lodes traversing them are of a fair size and suitable direction.

Rocks of that character increase in productiveness as the fracture becomes rough and uneven. It is especially the presence of felspar in large proportions that characterises the rocks throughout Cornwall and Devon, where large deposits of copper ore have been found. These are deep blue compact clay-slate, greenstone, elvan, and the whitish clay-slate, and in a very few localities granite. Granite characterised as quartzose indicates the presence of black and grey copper ores. Lodes in the soft kind of granite, containing large quantities of quartz, commonly yield grey copper ore in great abundance.

Copper lodes receding from the felspar rocks and approaching to primitive granite are almost always found to yield tin. If such copper lodes, however, are found in mines at a distance from such granite to fall in depth, they do not contain much tin. This fact is in accordance with a principle already adverted to, that tin lies nearer to primitive granite than copper. Before closing these remarks, I beg to notice a very common saying employed by individuals too indolent to observe for themselves. They assert that there is no knowing where the ore is, or, as they more usually phrase it, "Where it is, there it is." I readily acknowledge that up to the present time great uncertainty exists as to the result of mining operations. We are not only ignorant of the origin and causes of metalliferous deposits, but, in too many instances, of the phenomena that accompany them. From this lack of knowledge the most prudent miners are often at fault; and though enabled to say with almost unerring certainty under what circumstances profitable mines cannot be found, they are not equally able to foretel where they can be. It is something, however, to be enabled to prevent the misapplication of capital in exploring barren rocks, and localities where experience has satisfactorily proved that metallic ores are not to be found in sufficient quantities to pay the cost of extracting. I feel confident that continued and careful observation of all the circumstances developed in connection with our rich deposits of metallic ores would effect much more than this. We should find order, system, and arrangement here, as well as in every other department of nature.

* Read at the late meeting of the Cornwall Polytechnic Society.

VIEILLE MONTAGNE ZINC MINING COMPANY.

This association, which has at various periods been noticed in our columns from the commencement of its operations through all those difficulties which naturally arise in the formation of a large mining and manufacturing establishment, to a course of unwonted prosperity, stands now in an enviable position among the most important commercial communities of Europe. As doubtless many of our readers are aware, this company was formed for the purpose of working the ancient mines of calamine situate at Altenburg, Vieille Montagne, in Belgium, which is known to have been worked as long since as 1435, and, in all probability, at a much earlier period, since which, up to the present time, the mines have never ceased to produce large quantities of calamine, a carbonate of zinc, of a character almost free from impurities. It is well known that zinc in a metallic form was unknown to the ancients, although still large quantities of brass were produced by melting copper with calamine (*lapis calaminaris*); it was discovered early in the sixteenth century, as it is noticed by Paracelsus, who died in 1530, but does not appear to have been brought into use; probably from the difficulty of reduction.

In the year 1805 the Abbé Douy, while reducing calamine in the manufacture of brass, accidentally discovered a mode of condensing zinc from the ore, from which has arisen the present principle of manufacture known as the "Liege process of condensation." In 1808 zinc was known all over Europe, and its use was regarded as of some importance in the arts, from which it has risen to its present importance in a commercial point of view. In 1813 the concession made to the Abbé Douy came into the hands of the Mosselman family, and from that moment great progress and improvements took place in the development of the mines; the construction of furnaces and melting and condensing pots; in the manufacture of the metal, rolling into sheets, and other industrial operations; which have at length resulted in the present gigantic establishment, combining mining, smelting, rolling, and finishing the various articles of commercial value, to the extent of 20,000 tons per annum, being one-fourth of the entire produce from all the works of Europe together; combining operations giving employment to many thousands of workmen in Belgium, England, France, and America.

In 1837, the grant of these extensive estates, extending over 17,000 English acres, consisting of lands, forests, and mines, were converted by royal decree into a *société anonyme*, under date 28th of June. They are situate in the Belgium, Prussian, and neutral territories between the towns of Aix la Chapelle and Verviers. The metal, as assayed in London, is superlatively pure, giving—Zinc, 0·995; iron, 0·004;;traces of lead and sulphur, 0·001; probably the least contaminated zinc known. And from this circumstance alone might be presumed to have arisen the position the company holds in the commercial world, having established agencies in the principal marts, markets of England, France, Belgium, and the United States, to which, however, must be added the unwearied and persevering exertions of the directors and officials, and the high and honourable influence of the names of its promoters and supporters. Not only has the company been a great producer of the metal in a merchantable state, but have been the means of its introduction and application to a large variety of useful purposes, for which this metal was previously unknown, and its importance unappreciated. The purposes to which this highly useful metal are now applied may be classed under the following heads:—Cheap and solid zinc roofing for buildings; zinc sheathing for ships; zinc casts to imitate bronze; zinc oxides for paint, a substitute for lead, free from all injurious consequences to health; a large variety of articles for domestic, agricultural, architectural, and other useful and ornamental purposes; and in the Great Exhibition of 1851, in addition to the colossal statue of her Majesty, 21 feet in height, were a very large number of highly interesting objects in this metal, which we noticed at the time.

The company, in addition to former extensive operations, are now prepared to undertake, through their manufacturing agents, contracts for the execution of roofs of all dimensions in the United Kingdom, or for exportation to the colonies. These contracts may, if required, include timber and iron frame-work, an arrangement which will give great facility to numerous descriptions of emigrants, and enable them to overcome many difficulties which must necessarily otherwise occur. The form of these roofs may be either plain or corrugated, and of various designs, while the lightness of the material, and the flatness at which it may be laid, admits of a very considerable diminution in the dimensions of the under framing, and consequently a large saving in its cost. The durability of the material produced by this company has been tested by long use on the Continent, the roofs of very large and well-constructed buildings being in good condition after standing 20 years' exposure, without repair, testimonials of which may be seen. It has also become a highly popular roofing for railway stations, and buildings of all kinds in this country where its lightness, economy, and durability, and the ornamental forms in which it may be applied, strongly recommend it.

We shall conclude these remarks with a comparative statement, showing its assumed superiority over roofs of slates, tiles, and lead:—

A square of 100 ft. of zinc, at 22 ozs. to the foot (No. 14 gauge), weighs when laid on with laps and rolls 150 lbs.; the same surface in Bangor queen slates weighs 830 lbs., and in plain tiles 1900 lbs. Zinc is, consequently, 5½ times lighter than slates, and nearly 14 times lighter than tiles, in addition to the saving of surface and weight by the flatness and lightness of the frame-work and supporting walls. As compared with lead, the density of zinc is 7·19, while that of lead is 11·35; the tenacity of zinc is 109·8, and that of lead is 27·7, from whence it follows, that while a sheet of zinc of equal thickness to one of lead is only two-thirds the weight, its strength or sustaining power is four times that of lead, while the cost is proportionately low as applied to each material.

Mining in North America.—It was long supposed that the copper lodes on the north side of Lake Superior would not pay for working. According to recent accounts, it would appear that the native metal has been found there. A large vein has been discovered on Michipicoten Island, which is now being worked by the Quebec Mining Company. Some large veins have been likewise discovered in the region north of the Bruce Mine, as well as to the east of that place. Lake Huron, it would appear, is well situated for mining operations. Large masses of copper still continue to be raised from the mines on the American side of Lake Superior, and masses weighing several tons are met with. The last shipments amounted to 275 tons 18 cwts. 53 lbs. of native copper. In Floyd County, Virginia, deposits of copper ores have been traced for 40 miles—the course of them being analogous to the Blue Ridge, and following the sinuosities of the mountainous land. The proprietors of the land are about actively to commence mining operations.

THE BRITISH ASSOCIATION.

The twenty-fourth meeting of the British Association for the Advancement of Science, which recently held its sittings, for the second time, at Liverpool, was distinguished, as well by the numbers who attended, as by the variety and interest of the papers read in the several sections. The selection of, perhaps, the second seat in the world of commercial industry and enterprise, situated in the vicinity of the great manufacturing districts of England, attracted many practical men—with a number, therefore, of theoretical and speculative discussions on matters of philosophic enquiry, some subjects, having reference to industrial utility and mechanical improvement, necessarily demanded attention. As these more properly fall within our sphere, we propose to lay before our readers succinct notices of the leading papers which may be termed simply utilitarian, and whose objects seem to tend to rendering existing machinery more perfect, or to the further advancement of mechanical and practical art.

The important subject of Shipbuilding, one in which the mining community are deeply interested, is at this moment attracting attention commensurate with its vast importance, and it was presented to the Association in a variety of forms. As iron now enables us to build, and steam to manage and navigate, vessels of size and dimensions hitherto unknown, the increased number of human beings who commit their lives to the sea renders the risk of accidents more alarming, and the catastrophes more appalling, than at former periods, and has created speculation as to the safety of iron ships. Important papers were read, one by the Rev. Dr. Scoresby, in reference to changes in the action of the compasses in iron ships, and the other by Mr. J. T. Towson, secretary to the Local Marine Board, on the efficiency of the aids of science at present in connection with the compasses of iron ships. The melancholy loss of the *Tayleur* occupied a considerable part of Dr. Scoresby's paper, and while both concurred in many of their views, they seemed to feel that some mysterious magnetic agency and influences existed, but little understood, and which we are as yet but little able to control. They concurred in impressing the necessity of excessive watchfulness, and having appealed to the Section to devote to the subject its best consideration, Colonel Sabine, while stating that the Admiralty instructions as to compasses directed the utmost precaution to ascertain in every change of position their accordance, and to test their accuracy on every occasion which presented itself, promised the most anxious attention on the part of the Section. A paper, which was read by Sir John Ross, the celebrated arctic voyager, "On the Deviation of the Magnetic Needle peculiar to Liverpool," would seem to furnish a natural and satisfactory explanation of that sad occurrence. It is well known, that in ships sailing from that port, after having had their compasses swung in the Mersey, to ascertain the deviations, or to have them, as it is termed, *adjusted*, they have been found incorrect. This untoward circumstance Sir John Ross accounted for, as he considered that the Mersey was not an eligible locality for ascertaining the true deviation of the magnetic needle, the ships lying near places in which large masses of iron are deposited, which must influence the needle during the evolution of swinging the ship, while the embarkation of passengers, and other occurrences subsequent to that process, necessarily have a further sensible effect. He proposes, therefore, that two posts, or beacons, should be erected, true north and south of each other, in positions best seen by ships when coming down the Mersey, steering about true west, or west-north-west, by compass. When these two objects can be brought into one—*i. e.*, due north of each, both being south of the ship, either a verification of the deviation observed in the Mersey, or the amount of difference, will be shown; and if, further on, two other posts were erected on the magnetic meridian, the ships could observe the exact amount of the deviation. The adoption of such suggestions may tend to remove some of the prejudices which attach to iron-built ships, and thereby encourage and increase that important branch of trade.

Mr. Scott Russell, President of the Section of Mechanical Science, also communicated to the Association a paper bearing on the same highly important subject—viz., "On the Progress of Naval Architecture; including a Notice of the Large Ship of the Eastern Steam Navigation Company." A steam-ship that is not 180 feet long cannot be propelled at a speed of 16 miles an hour, without a great expenditure of power: 400 feet is the shortest length for a ship that is intended to be propelled at a speed as high as 24 miles an hour. As an illustration of this rule, it was mentioned that the *Himalaya*, which is 365 feet long, has attained the greatest speed which any trading ship has yet reached. In the construction of large ships, however, the builders were formerly met by the difficulty of being able to find wood of sufficient size for the requisite strength, since no means have yet been invented of joining pieces of wood together so as to give them the same strength as the whole timber would have. This want of material of sufficient size was supplied by using iron, for the joints can be made as strong as the whole plate, or plates of the required size can be rolled for the purpose. The facility of increasing the size of the material is a vast advantage derived from the use of iron, which affords opportunities for constructing ships of any size. The size of ships ought to be suited to the traffic, and to the distance, but it is only by employing very large ships that steam navigation to distant parts of the globe can be profitably carried on. A steam-ship to Australia, if it were not large enough to carry sufficient coal for the voyage, had to take in supplies over and over again, and at every station the cost of coal was necessarily increased. Under such disadvantages, freights could not pay the cost of conveyance; it was, therefore, necessary to build ships of sufficient size to carry coal for the voyage out and home, or equal to circumnavigating the globe. It was expected that the ship now being built would accomplish the voyage to Australia in 30 or 33 days; it will carry 6000 tons, besides its requisite quantity of coal. It would be 675 feet long, 83 feet in breadth, and 60 feet deep, and would have excellent accommodation for 500 first-class passengers, 600 second-class, and 1000 third-class passengers. Mr. Fairbairn observed, that Mr. Brunel had shown him the plans, and though he had at one time thought a ship of that size would be too large for strength, he had, after examining the plans, arrived at an opposite conclusion. He had now no doubt that the ship would be perfectly strong, and be able to bear a gale of wind without bending. It was built upon the same principle as the Britannia Tubular Bridge over the Menai Straits, and as that mode of construction had proved capable of sustaining a bridge without any support in the centre, there could be no doubt that, sustained as the ship would be by the water, it would, under all circumstances, be able to bear the strains to which it might be subjected.

A communication from Mr. Sewell was read, "On Boiler Explosions," and by Mr. Dircks, on the prevention of them; also one "On the Economical Working of Steam Boilers," by Mr. J. Chanter. These several papers gave rise to discussions, but the information which they elicited cannot be new to the constant readers of this Journal. If anything important shall appear in the reports when published in full, in the *Proceedings* of the Association, we shall present it to the public.

A paper in the Department of Mechanical Science, on an improved method of applying breaks to railway carriages, the invention of Mr. Ezra Miles, attracted great attention, and his plan met very general approval. Whether its application will succeed in preventing railway catastrophes remains to be proved; but this must be conceded, that the conception reflects high credit on his inventive genius, while the arrangements equally display his great mechanical skill. The contrivance is designed on a bold and novel principle—namely, to employ the force of steam in the boiler of the engine for the purpose of acting, when required, on the breaks of the carriages attached—the steam of the engine, in effect, controlling its own power. The invention consisted of two parts—first, an apparatus for more effectually applying existing breaks to each and every carriage of a train; and secondly, the means of connecting and disconnecting the apparatus between the several carriages composing the train. With respect to the first portion of the invention, it will be readily understood that, on the surface of the water in a locomotive boiler, there is a pressure of steam, equalling, on the average, (say) 100 lbs. to the square inch, being, in fact, the power which propels the engine with its attendant train. If into the locomotive boiler, below the water line, be inserted an iron tube, (say) of one inch diameter, closed at the end most distant from the boiler, that tube will become filled with water from the boiler, and will necessarily have exactly the same pressure on every inch of its surface as the water in the boiler itself, and will actually become part of that apparatus. By the insertion of a cock in the boiler, the pressure of this steam may be cut off or let on, according to circumstances, at pleasure. The power is thus placed at disposal, and Mr. Miles proposes the following application of it:—The iron tube or pipe is intended to be continued under every carriage and wagon, but, instead of being continuous, it is arranged that it

should enter in at one side, and out at the other, of a cylinder, also placed under, thus making the cylinder a part of the tube; and into this cylinder, 4½ inches diameter, and 3 inches stroke, is to be fitted a solid piston or plug. The tube entering below the piston into the cylinder, the pressure is turned on (say) at a force of 100 lbs. to every square inch, and the area of the cylinder, less the piston-rod, being 15·904, we have an effective pressure of 1500 lbs. to act upon the piston. As the piston is driven upwards by the pressure, the piston-rod is also elevated, and being connected with the levers of the ordinary breaks, they are at once brought in contact with the periphery of every wheel, and are kept so as long as the tube continues in communication with the boiler. A power equal to 1500 lbs. in each cylinder is thus brought to act directly on each break, independently of the increased power obtained by the leverage attached to the breaks. At present, however extended a train may be, as a man is required to work each break, there are only two, or perhaps three, in every train; by the proposed plan, there will be a break to every carriage, and, however numerous, the engine-driver, by merely turning a cock, is enabled to act upon every one of them at the same moment. Again, the engine-driver is, by the present system, on perceiving danger, obliged to signal the guard by the steam-whistle, as notice to him to commence screwing his break, by which time is necessarily lost, the train in the meanwhile rapidly approaching the object of danger. By the proposed method, however, no sooner does the engine-driver see the danger, than he turns the cock, and the whole of the breaks are instantly applied to the wheels, without the slightest shock to the train; while, by its adoption, the wear and tear of the wheels will be greatly reduced. Under the present system, the breaks being very limited, and the wheels being completely locked, when the train is required to be stopped, both the rails and the wheels suffer; but, by the number of the proposed breaks, the wheels may be allowed to rotate slowly, and thus avoid injury. It has been estimated that the cost of adapting the tubes and cylinders to each carriage will not exceed from 4*l.* to 5*l.* As the plan proposes that there should be a tube and cylinder under every carriage, the question then to be considered was, by what means, where there were several carriages, they were to be connected, enabling them at the same time to be coupled and uncoupled. In order to effect this object, and to have the apparatus of such strength as to sustain the same pressure as the boiler, and so flexible as to bear the oscillation of the train and the motion allowed by the play of the ordinary coupling chains, a plan equally novel and simple is suggested. In the terminal ends of the tube, connected with every carriage, it is proposed to insert a short, hollow tube, or cylinder, having a shoulder near its spring, which gives it, in effect, two different diameters. At the end of the tube already described is attached a hollow cone, fitting into the cylinder at the end of the tubes, and having a flange at its smaller extremity, over which a vulcanised india-rubber ring is slipped on to the cone. Upon the insertion of this cone into the hollow tube or cylinder, the india-rubber ring, on coming into contact with its inner surface, rolls upwards towards the base of the cone, acting as *packing*, and the greater the amount of pressure, the tighter and more secure the joint will become. On removing the pressure of the steam, and drawing out a pin which holds the two portions in their place, the joint may be immediately detached.

It is further proposed to employ the water in the continuous tube as a means of communication between the guard and the engine-driver. When the breaks are not required, the water in the tubes will be merely a continuous inert column, without any pressure upon it, and it is to be placed under the control of the guard by means of a small forcing pump. The tube will be connected with a small cylinder on the boiler, into which, when occasion requires, the water can be instantly forced by the guard; it will then raise a piston, which may either act on a steam-whistle, or ring a bell, or make any other known signal, as notice to the engine-driver. It is thus observable, that while the steam is, in effect, made the means of controlling its own power, the operation is placed equally under the command of the engine-driver and the guard. The invention seemed to meet the approbation of every person present, and Mr. MILES exhibited to the meeting one of the joints and cylinder which we have endeavoured to describe. Some of the engineers who were present considered the mode suggested of bringing a train to a standstill, while the wheels were permitted to rotate, a vast improvement on the existing plan of locking the wheels; while the contrivance for connecting the tube by the joint, as shown to the meeting, appeared so simple and effective, that it was considered well calculated to remove all difficulties in the way of applying the proposed hydraulic break.

It is impossible not to express high admiration of the mechanical ingenuity and inventive capacity exhibited in this very extraordinary contrivance. Practical difficulties may, perhaps, present themselves (and we fancy we see several), but if they can be overcome, the inventor will be well entitled, not only to the grateful acknowledgments of this country, but of the civilised world, for having accomplished one of the greatest desiderata of our times—that of rendering railway travelling comparatively secure. As the only mode of establishing its efficiency is by testing it, the entire apparatus is now in course of construction, adapted to a train of eight or ten carriages; and those who are interested in the invention offer to submit it, when completed and ready for work, to the general inspection of engineers and of the public. We shall anxiously watch the progress of the experimental trials, as we consider that it promises to afford a safeguard against future collisions of the terrific character we have so long and so often deplored.

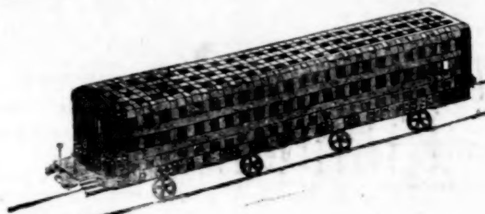
SMOKELESS FURNACE, AND ECONOMY.

Two months have now elapsed since the Act of the Legislature for the abatement of the nuisance arising from the ejection of dense masses of unconsumed carbon into the atmosphere from steam-engine and other furnaces came into operation, but without, we regret to say, the advantageous results which were very generally anticipated. From all that can be ascertained on the subject, it appears certain that among the vast number of furnaces in active operation in this great metropolis, by brewers, distillers, engineers, flour, drug, and other mills, sugar bakers, dyers, bakers' ovens, and numerous other occupations requiring a large consumption of fuel, comparatively a very small proportion have been so arranged as to meet the requirements of the Legislature. This cannot certainly arise from the non-exercise of scientific ingenuity in devising means for the thorough and perfect combustion of the fuel employed, as no less than from 100 to 120 different plans have actually been patented during the past half century, many of which, from actual observation of their successful action, have been favourably noticed in our columns. Of these we briefly referred in the *Mining Journal* of the 16th of September to a particularly simple and inexpensive arrangement, which about 12 months since was secured by patent to Messrs. Elmslie and Simpson, of Leather-lane, and for the manufacture of which Mr. C. J. Fox, of Pickard-street, is the sole licensee. It consists of a diaphragm of cast-iron, or fire-bricks depending from the bottom of the boiler at a certain distance from the bridge, either in front or behind, such distance being regulated by the size and depth of the furnace, and other circumstances. This diaphragm forms, an inverted arch, or bridge, and the current of air passing rapidly beneath, or through the space thus formed, carries the flame and smoke from the fresh fuel in front of the fire to impinge on, and become thoroughly incorporated with, the incandescent mass just before the bridge; whence, passing into the flues thoroughly intermingled with the appropriate quantity of air for complete combustion, no black smoke or coloured vapour escapes from the chimney, while every particle of fuel is brought to useful account, and the entire caloric engendered radiated over the heating surface of the boiler.

The proprietors believe this to be one of the most simple and efficacious plans yet submitted to the public, as it can be applied to most furnaces in operation, such as Cornish or eliptic boiler furnaces, marine-engine furnaces, dyers and brewers' coppers, and for numerous other similar processes; and having ourselves carefully inspected two furnaces in action, differently circumstanced, fitted with the invention, we can unhesitatingly assert that it fully effects all the patentees claim for it. One great recommendation to this plan is the facility with which it may be fixed—often in about four hours, in no case will it exceed a day, and that without the least disturbance or alteration of any portion of the furnace. Although constructed of iron it does not burn out in the short time which might be expected, and the part most exposed to the action of the fire being cast double the thickness of the other portions, the whole is rendered very durable, and when worn out can be replaced at a very small cost. We have here thus added another to the many facts recorded in the columns of the *Mining Journal* as evidence of the possibility of so constructing engine and other furnaces that they shall effect complete combustion of the coal or other fuel, and thus not only prevent smoke, but by the very means employed economy is secured, and a large annual saving effected, varying, according to circumstances, from 15 to 40 per cent. Mr. Fox has numerous testimonials as to the success of this furnace, from parties who have had the arrangement applied on their premises.

SAFETY CARRIAGES FOR RAILWAYS.

The idea of constructing the bodies of railway carriages to render them of greater strength than at present made, without, at the same time, adding materially to the weight, has long occupied the attention of some individuals, and which appears at length likely to be successfully carried out. In a brief notice in our last Journal, we stated that a newly-constructed carriage had been introduced, under the name of the life preserving car, with the view to prevent, as much as possible, fatal effects from concussion in cases of collision, and we now proceed to a more detailed description. Instead of being constructed of wood, as those now used, the body is formed of two sets of bands of steel or other metal, one set running longitudinally, and the other in a transverse direction, forming, as it were, a complete piece of metallic basket work, of the necessary dimensions for a carriage body. These bands are securely rivetted or screwed at every intersection, and where greatly increased strength is required the bands may be doubled, or even trebled, the rivets holding all firmly together, the outer covering, lining, and fittings up, being finished afterwards. This form of construction secures strength, and to nullify to the fullest extent the effects of concussion, a peculiar compound spring is introduced. Under the bottom of the carriage, placed longitudinally, is a wooden beam of large dimensions, on each end of which is fixed a thick mass of India-rubber, much compressed; over this, with its ends attached to each side of the floor of the carriage, passes a curved steel spring of the usual construction, from the centre of which, and opposite the end of the wooden beam, there projects a spiral steel spring, strongly secured in its place. It will thus be seen that in case of a collision the spiral springs receive the first shock, the concussive force is next communicated to the curved springs, and finally to the India-rubber, by which arrangement sudden jarring, and the consequent injury will, in most cases, be avoided.



This mode of constructing railway carriages has been introduced from the United States by Mr. La Mothe, and patented in this country by Mr. James Whitman, of New York, and the advantages claimed for the invention are, increased strength and power of resistance in cases of accident; lightness in weight in proportion to strength, as compared with carriages of wood; greater facility of construction, as two men with a punching and riveting machine can finish the frame work of a carriage 42 feet long, to hold 60 passengers, in two days, or even less; and diminished cost in the first instance, with much greater durability. These iron or steel cases or bodies are carefully lined throughout, and stuffed and padded with an elastic and yielding material, by which, in case of a shock, the infliction of wounds and bruises will be still further prevented, in addition to the effects of the compound buffers already described. Even should a collision of more than usually destructive force occur, these carriages would certainly have an additional advantage in giving way by bending, after the elasticity of the springs had been overcome; whereas carriages of wood in all such cases fly into splinters, and are completely destroyed.

NEW GREAT RAILWAY PROJECTS.

A preliminary prospectus has recently been issued for forming a central railway from the Harrogate Junction of the Great Northern, the Midlands, and other railways, to the Gretna Junction of the Caledonian and the Glasgow and South Western Railways, and to the Hawick Terminus of the railways from Edinburgh and from Berwick. The advantages of a central railway through Yorkshire, Westmoreland, Cumberland, Dumfriesshire, and Roxburghshire, have long been acknowledged, and efforts made to obtain portions of such a line, but from their being so strictly local, or too much under the influence of more powerful companies, they have failed in their object. It is now believed by one well organised and comprehensive scheme both local and general advantages will be attained. Some difficulty exists in selecting the route that will give the greatest benefit, as there are two different localities through which the proposed railway could pass; the promoters, therefore, solicit advice from the local authorities, surveyors, and all others possessing useful information, or a knowledge of the antimony, barytes, copper, hematite, iron, lead, coals, building stone, or other valuable mineral, which, more or less, abound along the routes. The first-named has the best gradients, and the lightest works from Harrogate to Gretna; but from Gretna to Hawick, the gradients are not so good by this route as by the second.

This line commences at Harrogate, where there is a highly favourable junction of lines from London, the Midland Counties, the south-eastern seaports, York, and Leeds. It then proceeds near to Ripley, Appleby, Glasonby, and Kirkoswold, to the Newcastle and Carlisle Railway, near Fenton, by which line access may be had to and from Carlisle and West Coast Railways. From Fenton the line proceeds to the Gretna Junction of the Caledonian, from whence access can be had to and from Carlisle, and the Lancaster and Carlisle Railway to Liverpool, Manchester, and London. The second route proposed is the most central and direct to Edinburg, as it would save fully 20 miles between that city and London, and about 120 miles from the county of Roxburg to London, over the present lines. By either route a central railway would be obtained, from which short branches, when well supported locally, could be made to develope the minerals, and give no ordinary local and public advantages to the agricultural, manufacturing, and mineral interests along the route; besides adding to the value of the Great Northern, the Caledonian, and the North British Railways.

The total length of the proposed line will be about 140 miles, and the title will be "The Great Central Railway," with a capital of 2,000,000*l.*, in 400,000 shares of 5*l.* each, deposit 1*l.* per share; but the promoters pledge themselves to return 18s., in the event of the Act of Parliament not being obtained. We shall refer again to this important undertaking in our next week's Journal.

Another new line of railway, for which Messrs. T. Robinson, of Appleby, and J. Richardson and T. D. Holmes, of Barnard-Castle, are named as the solicitors, is also about to be projected. It will be called the "York and Glasgow, Stockton and Darlington, and Lancaster and Carlisle Union Railway"—a truly comprehensive title. The line is intended to commence at the terminus of the Darlington and Barnard-Castle Railway, at Barnard-Castle, and proceed by way of Bowes, Stainmore, Brough, Appleby, Colby, Bolton, King's Meaburn, Morland, and Great Strickland, to a junction with the Lancaster and Carlisle Railway at Hackthorpe, near Lowther. The total length of the line will be 34 miles, and its estimated cost, including all works, lands, stations, engineering, and a liberal allowance for contingencies, will not exceed 315,000*l.* The route will be accomplished by unobjectionable gradients, and without any tunnel. It will (says the prospectus) be the shortest mode of railway transit between York and Glasgow, and consequently between the eastern portions of England and the south-western parts of Scotland, the communication between which exists at present only by circuitous routes, involving great cost and loss of time. It will complete a system of railway communication across the island for uniting the east coast and its extensive and flourishing ports of Sunderland, Stockton, Hull, Seaham, Hartlepool, and Middlesborough, with Liverpool, Fleetwood, Lancaster, Morecombe Bay, Whitehaven, Workington, Maryport, and other ports and places on the western coast. It will give the best and most direct means of carriage for coal and coke of the best description, from the celebrated Durham coal field to the western ports above named, besides supplying those articles to the countries of Westmorland and Cumberland, and the nothern parts of Lancashire and Yorkshire. It is also one of the important features of the scheme, that will open out a direct and easy means for supplying Ireland with Durham coal and coke. The discovery of immense and inexhaustible fields of iron ore in Cleveland, in Yorkshire, has opened out a field of manufactures in that district of immense importance. The hematite ores of Whitehaven and Ulverston have been found not merely valuable, but absolutely requisite as a mixture with the Cleveland ores, in order to the production of superior quality of iron. The railway will form a direct route for the transmission of the hematite ores to Middlesborough, Darlington, Eston and other places, where extensive iron furnaces are now in operation, and in course of being extended. The cattle fairs of Brough Hill and other places in Westmorland (hitherto destitute of railway communication) are amongst the largest of England. This line will supply the accommodation requisite for this important description of traffic, and be the nearest mode for reaching the fairs of Carlisle and Penrith, in Cumberland, and of Falkirk, Dumfries, and Glasgow, in Scotland, from whence immense quantities of cattle and sheep would be forwarded by this line to Lincolnshire, Norfolk, and the various eastern counties, which at present are taken by indirect and expensive routes. The county of Westmorland would pass its important and increasing agricultural produce by this railway, to the densely populated towns and districts of Yorkshire, Durham, and Northumberland, and receive in return their manufactures and coal. The district through which the present line will pass abounds with the richest mountain limestone, and possesses important lead mines, and large beds of argillaceous and ryder ironstone, which only require the aid of railway communication for their active and extensive development.

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